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Faculty Attendance Monitoring System: An improved feature with Barcode Scanner

Higher education institutions (HEIs) seek ways to help students succeed at school. One way to make them academically successful is to ensure the regular attendance of the faculty at their classes.¹ The importance of the teachers' attendance at class is undeniable. Their attendance motivates students to attend their classes (Brewer, 2005), and students' presence in the class signifies a transfer of knowledge from the teacher to the students and vice versa.

The HEIs have their own way of monitoring the attendance of their faculty. Some schools use logbooks while some use computer-based systems such as biometrics, Radio Frequency Identification (RFID,) and barcodes. Each of the attendance monitoring systems has its own advantages and disadvantages. For one, the biometric system is basically used for identification (Bigun, 2004) and verification (Jain, 2004). Such system has three advantages in terms of accountability, efficiency, and profit. However, the system's verification function does not work all the time with all types of biometrics (Taniola, 2014). Olatunbosun et al. (2013) developed an RFID-based student attendance management system. The system is time efficient and ensures accurate data entry. Barcodes, on the other hand, are used to increase the speed and accuracy of reading and entering data (gdom.net). Barcodes are used in events, travel, movies, advertisements, and games (Kostanecki, 2014). Moreover, they are often seen in various products sold in malls and supermarkets, making cashiering and POS faster.

1 The research study and writing for this paper was divided as such: Allen James C. Gomez conceptualized the study, the software development, and paper writing; Nelson G. Liwanen, Jr and Benzar Glen S. Grepon gathered the review of related literature; Cyril Jane C. Ranido managed the conduct of the study and edited the final paper.

Many organizations are already embracing barcoding for their daily transactions. In the academe, Capitol University uses barcodes in the Identification Card of students and employees. Barcoded ID is used for borrowing and returning books. Some schools are using the barcode technology in monitoring the attendance of their students and faculty. In Malaysia, N.L.B. Mahmud (n.d.) developed a student attendance online system using a barcode reader. It was developed to help the lecturers monitor the attendance of their students. In India, a barcode-based student attendance system was also developed to improve the operational efficiency and effectiveness of attendance checking (K.Lakshmi Sudha, et al., 2015).

Capitol University uses the biometric system, particularly the fingerprint scanner, in checking the attendance of its employees. However, the system is limited to log-in and log-out. It does not monitor the faculty's attendance per subject schedule, which is done through a room-to-room checking by a student assistant of each college. The traditional system of monitoring the attendance of the faculty per schedule consumes time and the signing of the logbook disrupts the class.

This study aimed at designing and developing for Capitol University a barcode-based faculty attendance system using the System Development Life Cycle, specifically the Waterfall Model, as framework. The development of the system was geared toward the improvement of the school's faculty attendance monitoring, making it efficient in terms of time, recording, and coverage.

System Development

The system was designed and developed using a framework known as System Development Life Cycle (SDLC), specifically the Waterfall approach. SDLC is a widely used framework for system development in many organizations, featuring several phases that mark the progress of the systems analysis and design effort (Hoffer et al., 2002). This framework allows system development to be more efficient by following processes to achieve the goals.

Data Gathering

The first phase of the waterfall model is data gathering. The researchers conducted an interview and a document review. Interviewed about the faculty attendance monitoring and reporting of the college

were the secretary and the dean of Computer Studies. Documents reviewed were the following: Teacher's Load Report (TLR), attendance monitoring log, and summary of faculty attendance report.

Analysis and Design

Analysing the requirements is very important in designing the overall functionalities of the system. The analysis involved the consolidation of documents and identification of some interventions based on the data. After the analysis of the data, the researchers designed a database. Each of the developed software was incorporated into the database to ensure inclusion of all the data from the documents. Next, the researchers created a diagram design (Entity Relationship Diagram [ERD] and Data Flow Diagram [DFD]) that covered all of the automated system processes. The ERD and DFD show the step-by-step process of the automated system from accepting raw data, processing the electronic data, to producing information about the faculty's time log.

Development

After the process was completed, the researchers developed the program for time and attendance to process raw data and generate report of the faculty's logging (in and out). The software used for the program development included Xampp and Visual Studio. Xampp software was used to create a database design and store data while Visual Studio was used to create and develop time and attendance application, from the application design to the functionality of the modules in the application.

Testing and Implementation

System testing was the last phase that determined the accuracy of the automated system. The system must accurately compare the faculty's registered class schedule to the attendance logs of the faculty by scanning the barcodes using a barcode scanner. To properly test the automated system, the researchers implemented it to its target environment. During this phase, the researchers registered the TLR of the faculty of the College of Computer Studies in the Time and Attendance System. The registered faculty schedule was compared to the time and date when the faculty logged in and out of the system. Barcodes were attached at the back of the faculty's ID card. The information embedded in the barcodes was the faculty's ID number. Before and after class, the faculty swiped their ID through the barcode reader for class attendance. The automated system then picked the equivalent ID number of the barcode of the faculty ID and compared it to the registered faculty information. When

the ID number matched with the ID number stored in the database, the system processed the attendance monitoring, retrieving the registered class schedule of the faculty and comparing it to the data (date and time) picked from the barcode scanner. If the faculty were already late from the class when the ID was swiped, the system would calculate the incurred number of minutes of tardiness.

Evaluation

The evaluation of the automated system was the final phase of the study. This phase requires validation of the systems output based on the specifications and expected outcome, which is the correctness of data generated by the system. To evaluate the correctness of the data, the researchers captured the time stamp (system login of the faculty) and compared it with the record of time generated by the system. Furthermore, the total count of time for tardiness generated by the system was also verified.

System Output

Figure 1 displays the output generated by the system on the registered class schedule of the faculty based on their respective Teacher's Load Report for first semester 2017-2018. The information displayed on the screen is used by the system to compare the actual date and time of Log-in and Log-out of the faculty and served as basis for the processing and generation of reports on the tardiness of the faculty as shown in Figure 2 and the Attendance of the faculty as shown in Figure 3. This module can display the class schedule either of one faculty or of all faculty at once.

The screenshot shows a software window titled "Faculty's Records". On the left, there is a search panel with a dropdown menu set to "Teacher's Load", a search bar, and a list of faculty members. The main area displays a table of registered schedules.

ID	Name	Subject Code	Subject	Classroom	Date	Time
50087	Nelson G Livanan	IT405	Network Design and Management	Class B	Wednesday	01:00:00 - 02:30:00
50087	Nelson G Livanan	IT405	Network Design and Management	Room 320	Friday	08:00:00 - 09:00:00
50087	Nelson G Livanan	IT405	Network Design and Management	Room 320	Wednesday	08:00:00 - 09:00:00
50087	Nelson G Livanan	CompSci50b	Network Technologies and Network A.	Class B	Thursday	03:00:00 - 04:30:00
50087	Nelson G Livanan	CompSci50b	Network Technologies and Network A.	Class B	Tuesday	03:00:00 - 04:30:00
50087	Nelson G Livanan	IT405	Network Design and Management	Class B	Friday	01:00:00 - 02:30:00
50087	Nelson G Livanan	CompSci48	Routing and Switching Essentials	Class A	Monday	09:00:00 - 12:00:00
50087	Nelson G Livanan	CompSci48b	BCE Elective 3: Advanced Routing, Swit.	Class A	Wednesday	09:00:00 - 10:30:00
50087	Nelson G Livanan	CompSci48b	BCE Elective 3: Advanced Routing, Swit.	Class A	Friday	09:00:00 - 10:30:00
50087	Nelson G Livanan	CompSci48b	BCE Elective 3: Advanced Routing, Swit.	Class B	Wednesday	10:30:00 - 12:00:00
50087	Nelson G Livanan	CompSci48b	BCE Elective 3: Advanced Routing, Swit.	Class B	Friday	10:30:00 - 12:00:00
50078	Milo S Capandahan	CompSci33	Multimedia Systems	Computer Lab-C	Tuesday	08:00:00 - 10:30:00
50078	Milo S Capandahan	CompSci33	Multimedia Systems	Computer Lab-C	Thursday	08:00:00 - 10:30:00
50078	Milo S Capandahan	CompSci33	Multimedia Systems	Computer Lab-A	Wednesday	09:00:00 - 12:00:00
50078	Milo S Capandahan	CompSci33	Multimedia Systems	Computer Lab-A	Friday	09:00:00 - 12:00:00

Fig. 1. Faculty Registered Schedules

Figure 2 is the screenshot of the actual report generated by the system on the actual log-in and log-out of the faculty. This module displays the total time of tardiness incurred by a faculty. The user must enter first the

ID number of a faculty for the system to display the attendance record of that faculty. The overall time of tardiness is found at the bottom right portion of the window box and has a font colour of red.

The screenshot shows a window titled "Sanitál Biniherditi" with a search bar at the top left containing "50087" and a "Print" button at the top right. Below the search bar is a table with the following columns: ID, Name, Department, Date, Time In, Time Out, Classroom, Login Remarks, Logout Remarks, and Total minutes of late. The table contains 15 rows of data for Nelson G. Livanen. At the bottom right of the window, the text "09:21:09" is displayed in red.

ID	Name	Department	Date	Time In	Time Out	Classroom	Login Remarks	Logout Remarks	Total minutes of late
50087	Nelson G Livanen	Computer Studies	2017-07-10	01:03:56	03:56:53	Cisco B	Late	early	00:03:56
50087	Nelson G Livanen	Computer Studies	2017-07-10	00:00:00	00:00:00	Cisco A			00:00:00
50087	Nelson G Livanen	Computer Studies	2017-07-10	11:36:08	12:09:47	Cisco A	Late	late	02:36:08
50087	Nelson G Livanen	Computer Studies	2017-07-07	00:00:00	00:00:00	Cisco B			00:00:00
50087	Nelson G Livanen	Computer Studies	2017-07-07	01:04:34	02:36:04	Cisco B	Late	late	00:04:34
50087	Nelson G Livanen	Computer Studies	2017-07-07	00:00:00	11:56:55	Cisco B		early	00:00:00
50087	Nelson G Livanen	Computer Studies	2017-07-07	08:06:07	09:07:29	Room 320	Late	late	00:06:07
50087	Nelson G Livanen	Computer Studies	2017-07-07	09:07:37	00:00:00	Cisco A	Late		00:07:37
50087	Nelson G Livanen	Computer Studies	2017-07-11	00:00:00	00:00:00	Cisco B			00:00:00
50087	Nelson G Livanen	Computer Studies	2017-07-12	00:00:00	00:00:00	Cisco A			00:00:00
50087	Nelson G Livanen	Computer Studies	2017-07-12	00:00:00	00:00:00	Cisco B			00:00:00
50087	Nelson G Livanen	Computer Studies	2017-07-12	00:00:00	02:22:03	Cisco B		early	00:00:00
50087	Nelson G Livanen	Computer Studies	2017-07-12	00:00:00	00:00:00	Cisco A			00:00:00

Fig. 2. Faculty's Total Time of Tardiness

Figure 3 is the screenshot of the actual attendance report generated by the system. This module provides a full detail of faculty attendance log report. This report specifies the faculty's time logs (in and out) on a particular date. The module also identifies the status of a faculty – present or absent.

The screenshot shows a window titled "Sanitál Biniherditi" with a yellow header "Attendance Log". Below the header is a table with the following columns: ID, Name, Date, Day, Time In, Time Out, Login Remarks, Logout Remarks, and Status. The table contains 15 rows of data for various faculty members. At the bottom of the window, the text "09:21:09" is displayed in red.

ID	Name	Date	Day	Time In	Time Out	Login Remarks	Logout Remarks	Status
50158	Benzer Glens.Grepon	2017-07-11	Tuesday	00:00:00	00:00:00			Absent
50087	NelsonG Livanen	2017-07-11	Tuesday	00:00:00	00:00:00			Absent
50158	Benzer Glens.Grepon	2017-07-11	Tuesday	00:00:00	02:29:16		early	logout
50087	NelsonG Livanen	2017-07-11	Tuesday	01:15:07	00:00:00	On Time		login
50158	Benzer Glens.Grepon	2017-07-11	Tuesday	00:00:00	00:00:00			Absent
50158	Benzer Glens.Grepon	2017-07-11	Tuesday	08:58:42	00:00:00	Early		login
50087	NelsonG Livanen	2017-07-11	Tuesday	00:00:00	00:00:00			Absent
50078	MilosCagandahan	2017-07-11	Tuesday	00:00:00	00:00:00			Absent
50403	Allen JamesC.Gomez	2017-07-11	Tuesday	00:00:00	00:00:00			Absent
50158	Benzer Glens.Grepon	2016-03-09	Wednesday	06:02:41	00:00:00	Late		login
50087	NelsonG Livanen	2017-07-10	Monday	01:03:56	03:56:53	Late	early	logout
50087	NelsonG Livanen	2017-07-10	Monday	00:00:00	00:00:00			Absent
50087	NelsonG Livanen	2017-07-10	Monday	11:36:08	12:09:47	Late	late	logout
50403	Allen JamesC.Gomez	2017-06-27	Tuesday	04:54:13	00:00:00	Early		login
50158	Benzer Glens.Grepon	2017-07-07	Friday	00:00:00	00:00:00			Absent

Fig. 3. Faculty Attendance Report

Conclusion and Recommendations

After a couple of months of implementing and testing the system, the researchers conclude that the Faculty Attendance Monitoring System using the Barcode Scanner is very helpful in monitoring the faculty's attendance per subject schedule. The adoption of such system will increase the work productivity of the secretary of the College dean considering that most of the secretary's work is spent on monitoring the faculty attendance. Furthermore, the system compels the faculty to attend their respective classes on time and regularly as expected of them. Also, the system provides the administration with accurate reports on faculty attendance. To maximize the use of the system, the university may consider the following recommendations: 1) add to the system an application that captures actual classroom image based on the room planner, 2) install the system in every floor of the academic building, and 3) update the system by providing mechanisms that verify the status of faculty in cases of failure to login due to approved leave of absence.

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